

**REMARKS**

This request for reconsideration is filed in response to the Office Action dated June 22, 2010. For the following reasons this application should be allowed and the case passed to issue.

Claims 1, 4-9, 16-22, and 25-27 are pending in this application. Claims 1, 4-9, 16-22, and 25-27 have been rejected. Claims 2, 3, 10-15, 23, and 24 were previously canceled.

***Claim Rejections Under 35 U.S.C. §§ 102/103***

Claims 1, 4-6, 9, 16-22, and 25-27 were rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, as obvious over Delnick (US 5,948,464), as evidenced by Walls et al. (*Fumed Silica-Based Composite Polymer Electrolytes: Synthesis, Rheology, and Electrochemistry*). The Office Action found that Delnick discloses a separator comprising a silica filler and a polymer binder. The separator comprises indefinite-shape particles comprising shapes of dendrites, grape clusters, or coral. The Office Action found that Walls et al. disclose that fumed silica consists of fused silica particles. The Office Action further found that Delnick clearly teaches leaving the interstices open is a result effective variable.

Claims 1, 5, 16, 18, 26, and 27 were rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, as obvious over Gozdz (US 5,571,634), as evidenced by Walls et al. The Office Action found that Gozdz discloses a separator comprising fumed silica or fumed alumina and DBP binder. The Office Action further found that the fumed silica and fumed alumina would inherently have indefinite shapes with necks. The Office Action found that Walls et al. disclose that fumed silica consists of fused silica particles.

These rejections are traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the present invention, as claimed, and the cited prior art.

Delnick and Gozdz do not anticipate or render obvious the claimed secondary batteries because the cited references do not disclose or suggest the porous electron-insulating layer comprising a particulate filler comprising an indefinite-shape particle having a neck and the neck is formed between and joins at least a pair of single crystalline particles and the layer has a porosity of 50% or more and the indefinite-shape particles maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry, as required by claim 1; and the porous electron-insulating layer has a porosity of 50% or more and the indefinite-shape particles are polycrystalline particles comprising a plurality of single crystalline particles that are diffusion bonded to each other, and a neck formed between at least a pair of the single crystalline particles, the neck comprising the same material as the single crystalline particles, as required by claim 16. Neither Delnick nor Gozdz disclose or suggest the claimed porosity or neck.

Please note that Gozdz discloses using 10-70% on a polymer basis of a finely-divided inorganic filler (col. 2:50-57). In Example 1, Gozdz uses 4 g of filler per 6 g of polymer. At such a high weight ratio of polymer to silica a porosity of 50% or more cannot be obtained. Further, the prior art fumed silica does not comprise a plurality of single crystalline particles that are diffusion bonded to each other, as required by claim 16. US Patent No. 6,084,767 to Day and US Patent No. 5,965,299 to Khan et al. provide support for Applicants' position. Fumed silica is usually an agglomerate of spherical superfine particles produced when silane gas ( $\text{SiH}_4$ ) is oxidized or silicon in a gaseous state is oxidized in an arc flame. Day discloses (column 2, lines 42-45) that fumed silica is an agglomeration of small spheroids of about 12 to 13 nanometers in diameter. In other words, fumed silica is an agglomerate of spherical fine particles and has **no neck** formed between a pair of single crystal particles. Furthermore, it is evident in Khan et al.

(Figs. 2 and 3) that fumed silica is not in the form of dendritic polycrystalline particles having a neck formed between a pair of single crystal particles. For example, in Fig. 3 of Khan et al., the particles are agglomerated through cross-linking of the functional groups (C=C) on the surface of the particles instead of necks. In the case of cross-linking, even if a neck is formed, and there is no indication that a neck is formed, the neck would not be of the same material as the single crystalline particles. Furthermore, as explained on page 9 the response filed June 18, 2008, and page 7 of the response filed November 10, 2009, diffusion bonding has an art recognized definition:

Diffusion bonding of materials in the solid state is a process for making a monolithic joint through the formation of bonds at atomic level, as a result of closure of the mating surfaces due to the local plastic deformation at elevated temperature which aids interdiffusion at the surface layers of the materials being joined.

Clearly the cited prior art does not disclose or suggest "diffusion bonded," as required by claim 16.

The Examiner found, "Delnick clearly teaches leaving the interstices open is a result effective variable" (page 4 of Office Action). While one of ordinary skill in this art would recognize that open interstices are needed to allow electrolyte permeability, the necessity of interstices for allowing electrolyte permeability is not the same as the number of interstices required for significantly affecting large current behavior in a low temperature environment. There is a difference between the number of interstices needed for normal battery reactions and for enabling a significant improvement in discharge characteristics at 0 °C and the 2C discharge rate. As shown in Tables 1 and 2 (paras. [0066] and [0080]), the discharge characteristics 0 °C and the 2C discharge rate significantly degrade at porosities below 50%.

The factual determination of lack of novelty under 35 U.S.C. § 102 requires the disclosure in a single reference of each element of a claimed invention. *Helifix Ltd. v. Blok-Lok Ltd.*, 208 F.3d 1339, 54 USPQ2d 1299 (Fed. Cir. 2000); *Electro Medical Systems S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 32 USPQ2d 1017 (Fed. Cir. 1994); *Hoover Group, Inc. v. Custom Metalcraft, Inc.*, 66 F.3d 399, 36 USPQ2d 1101 (Fed. Cir. 1995); *Minnesota Mining & Manufacturing Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 24 USPQ2d 1321 (Fed. Cir. 1992); *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051 (Fed. Cir. 1987). Because Delnick and Gozdz do not disclose the porous electron-insulating layer comprising a particulate filler comprising an indefinite-shape particle having a neck and the neck is formed between and joins at least a pair of single crystalline particles and the layer has a porosity of 50% or more and the indefinite-shape particles maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry, as required by claim 1; and the porous electron-insulating layer has a porosity of 50% or more and the indefinite-shape particles are polycrystalline particles comprising a plurality of single crystalline particles that are diffusion bonded to each other, and a neck formed between at least a pair of the single crystalline particles, the neck comprising the same material as the single crystalline particles, as required by claim 16, Delnick and Gozdz do not anticipate claims 1 and 16.

Claim 8 was rejected under 35 U.S.C. § 103(a) as obvious over Delnick. The Office Action considered it obvious that a lithium ion battery would comprise non-aqueous solvent and a lithium salt. This rejection is traversed, and reconsideration and withdrawal thereof respectively requested.

Delnick does not suggest the claimed secondary battery because Delnick does not suggest the porous electron-insulating layer has a porosity of 50% or more, the neck, and the indefinite-shape particles maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry, as required by claim 1.

Applicants further submit that Gozdz does not suggest the claimed secondary battery.

Claims 7 and 20 are rejected under 35 U.S.C. § 103(a) as obvious over Delnick in view of Waterhouse (US 4,363,856). The Office Action acknowledged that Delnick does not disclose the resin binder comprises a polyacrylic acid derivative. The Office Action relied on the Waterhouse teaching of acrylic acid as a binder in a separator to conclude that it would have been obvious to substitute acrylic acid as a binder into the separator of Delnick because the selection of a known material based on the suitability for its intended use is obvious. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

Delnick, Walls et al., and Waterhouse, whether taken in combination, or taken alone, do not render obvious the claimed secondary batteries because Waterhouse does not cure the deficiencies of Delnick and Walls et al. Waterhouse does not disclose or suggest the porous electron-insulating layer comprising a particulate filler comprising an indefinite-shape particle having a neck and the neck is formed between and joins at least a pair of single crystalline particles and the layer, has a porosity of 50% or more, and the indefinite-shape particles maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry, as required by claim 1; and the porous electron-insulating layer has a porosity of 50% or more and the indefinite-shape particles are polycrystalline particles comprising a plurality of single crystalline particles that are diffusion bonded to each other, and a neck formed

between at least a pair of the single crystalline particles, the neck comprising the same material as the single crystalline particles, as required by claim 16.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). There is no suggestion in Delnick, Gozdz, Walls et al., and Waterhouse to modify the Delnick and Gozdz batteries so that the porous electron-insulating layer comprising a particulate filler comprising an indefinite-shape particle having a neck and the neck is formed between and joins at least a pair of single crystalline particles, the layer has a porosity of 50% or more, and the indefinite-shape particles maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry, as required by claim 1; and the porous electron-insulating layer has a porosity of 50% or more and the indefinite-shape particles are polycrystalline particles comprising a plurality of single crystalline particles that are diffusion bonded to each other, and a neck formed between at least a pair of the single crystalline particles, the neck comprising the same material as the single crystalline particles, as required by claim 16.

The only teaching of the claimed secondary batteries is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must not be based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The dependent claims are allowable for at least the same reasons as the independent claims from which they depend, and further distinguish the claimed secondary batteries. For example, the cited references do not suggest the indefinite-shape particle comprises a plurality of primary particles bonded to each other, and the indefinite-shape particle has a mean particle size that is twice or more than the mean particle size of the primary particles and not more than 10  $\mu\text{m}$ , as required by claim 4.

Claim 9 further requires a separator sheet that is interposed between said positive electrode and said negative electrode, said separator sheet being independent of both said positive electrode and said negative electrode. As disclosed in an example in the present specification, a relatively thin separator of 15  $\mu\text{m}$  paired with 5  $\mu\text{m}$  heat-resistant layers (paras. [0072] and [0073]) provides superior performance at low temperature (0 °C) and high discharge rate (2C) (see Table 2). Delnick, on the other hand, disclose examples with much thicker separators. The thickness of Delnick separator (which corresponds to the heat-resistant layer of the present invention) is exemplified as 55  $\mu\text{m}$ , 97  $\mu\text{m}$ , and 77  $\mu\text{m}$  (Examples 1, 2, and 3), which is extremely thick. Further, there is no suggest of the claimed porosity, or any effect of porosity on low-temperature, high-rate discharge in Delnick or Gozdz.

### ***Response to Arguments***

Walls teaches that fumed silica comprises "fused  $\text{SiO}_2$  particles," and Day teaches that fumed silica is an agglomeration of 12-13 nm spheroids, the spheroids forming "a backbone of branching dendritic structures."

The Examiner maintains that each fumed silica particle has a neck which comprises the same material as the single crystalline particle. However, the bases for this finding is vague. The Examiner cites the expression of "fused  $\text{SiO}_2$  particles," and Day teaches that fumed silica is

an agglomeration of 12-13 nm spheroids, the spheroids forming "a backbone of branching dendritic structures" as support.

The description of the unique features of fumed silica are its branched, primary structure consisting of fused  $\text{SiO}_2$  particles (Fig. 1) in Walls, in fact, refers to the smallest unit of the branching structure of the fumed silica of Fig. 1, as being a fused  $\text{SiO}_2$  particle in small spheroid form. Further, the backbone of branching dendritic structures of Day is formed by the small spheroids coming into contact with one another at a point, and Day fails to teach or suggest the presence of a neck. Likewise, Walls fails to teach or suggest the claimed neck.

The present claims require a neck between a pair of crystalline particles, wherein the neck comprises the same material as the single crystalline particles. The cited references fail to teach or suggest the claimed neck. The neck has a structure as illustrated in attached EXHIBIT X and EXHIBIT Y. The neck is formed of the same material as the particles, thus the neck has a high structural strength. The high structural strength allows the indefinite-shape particles to "maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry," as required by claim 1. The prior art filler, on the other hand, has no neck formed between single crystalline particles and formed of the same material as the single crystalline particles. Fumed silica comprising small spheroids coming into contact with each other at a point do not have the claimed neck. Thus, the prior art fumed silica do not maintain their shape when subjected to a shearing force to disperse the particles in a liquid component to form a slurry.

The difference between the separator of Delnick and the present invention is illustrated in attached EXHIBIT Y. Y(a) illustrates the separator of Delnick, and Y(b) illustrates the porous film of the present invention. In Y(a) spheroid solid particulates (32) are bound to each other via



a polymer binder (34). On the other hand, in Y(b), a polycrystalline particle (103) is composed of single crystalline particles (101) and a neck (102) formed of the same material as the single crystalline particles. A binder (104) binds the polycrystalline particles with one another. The individual particles (32) of Delnick do not contain necks, like the necks (102) of the presently claimed particulate filler.

EXHIBIT Y further highlights the differences between the presently claimed particulate filler and the cited prior art. For example, Fig. 1 of Walls shows a state where a plurality of small spheroids, which come into contact with another at a point, are dispersed in a sufficient amount of PEO. There is no teaching or suggestion that the plurality of small spheroids have a neck, as required by claims 1 and 16.

In view of the above remarks, Applicants submit that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

**Application No.: 10/555,657**

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP



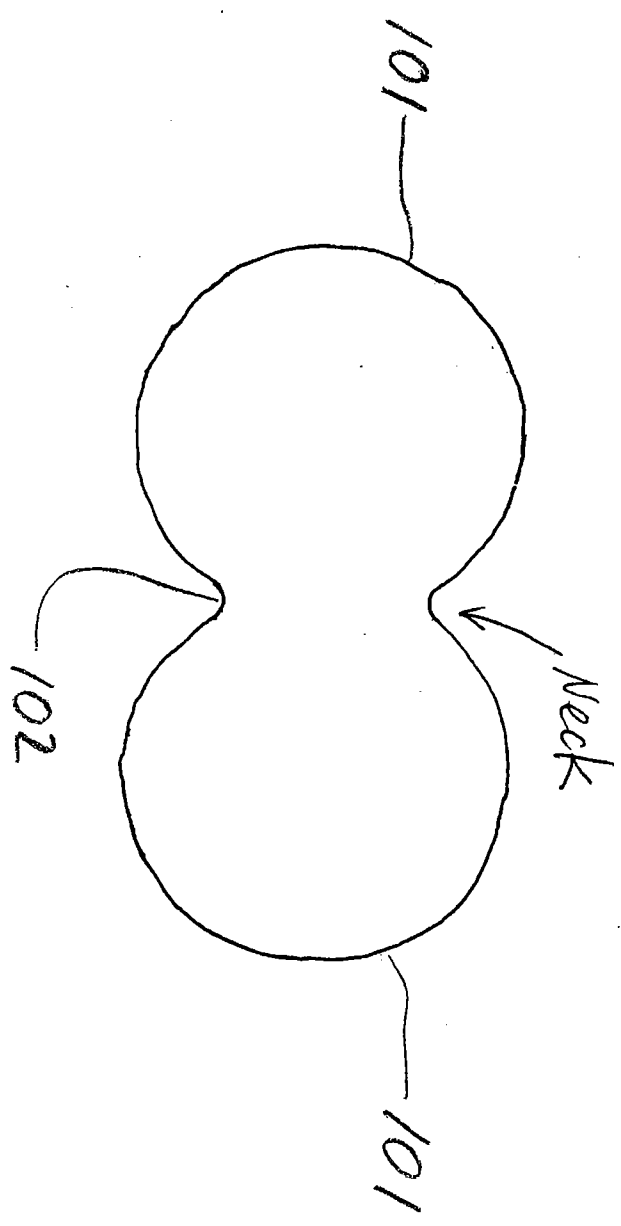
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EXHIBIT X



# EXHIBIT Y

